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Application of Advanced Wflow_sbm Model with the CMIP6 climate projection for flood prediction in the data-scarce: Lake-Tana Basin, Ethiopia

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Abstract: Flood-attributed damages to infrastructure and public safety are expected to escalate in the future due to climate change, land use change, and associated hydrologic changes. In recent years, the reliability of flood forecasts has increased due to the availability of meteorological and hydrological data and advancements in flood prediction science. However, there is limited effort to apply emerging advanced hydrological models for flood prediction in poorly gauged watersheds. The overall objective of this study is to demonstrate applicability of climate model products to generate reliable flood predictions for data-limited and flood-prone areas. In this study, the most recent high-resolution climate models of the Coupled Model Intercomparison Project Phase 6 (CMIP6) were evaluated to assess the impacts of projected climate change on the flood-prone areas of the Lake Tana basin, Ethiopia. The ensemble means of the top five CMIP6 climate model forcing data were used to calibrate and validate a free open-source, spatially distributed hydrological model known as Wflow_sbm. Model-independent multi-algorithm optimization and parameter estimation tool is implemented for calibration and validation of Wflow. In terms of simulating runoff and flood events, application of Wflow_sbm to the Lake Tana basin provided promising results. This study serves as a major step towards the development and implementation of climate model product-driven hydrological model to assess flooding damages of future climate projections within the poorly gauged Lake Tana basin.